ENVIRONMENTAL STATEMENT

FOR

AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA

JULY 1971

Summary Environmental Impact Statement
Ames Research Center
National Aeronautics and Space Administration
Moffett Field, California

This is an institutional environmental impact statement for the NASA-Ames Research Center located at Moffett Field, California. Ames conducts research and development in the fields of aeronautics, astronautics, and life sciences; and also manages a variety of scientific satellites and spacecraft projects such as Pioneer, PAET, and SPARCS.

The Center is situated on 365.5 acres of land which borders the southern end of the San Francisco Bay. None of the activities of the Center have been found to have an adverse environmental effect. A program is underway to monitor the Center's emission and effluents to insure that levels of pollutants remain below established standards.

In view of the Center's minimal environmental impact no alternatives to operation at its present location have been considered.

The Center's Draft Statement was made available to the Council for Environmental Quality on March 1, 1971. It was also sent to the Office of Management and Budget and the Environmental Protection Agency. No comments have been received from any of these agencies.

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I. INTRODUCTION

A considerable effort has been expended over the years to insure that the activities of the Ames Research Center did not adversely affect the environment. This effort was diffused through several organizations not identified as a separate function. With the increased concern nationwide to preserve our environmental quality, the need for a formalized organization was recognized. Such an organization has been established and will be documented by a Management Manual Issuance in the near future.

In the preparation of this statement a brief review of all Center activities was made. While no instances of federal, state, or local code violations were discovered, several activities were identified which require corrective action to conform with the spirit of Executive Order 11514. Such corrective action is being implemented at this time.

The U. S. Army Corps of Engineers visit for the purpose of evaluating our activities with respect to environmental pollution verified our own reviews. More detailed analyses of existing activities will be undertaken in the future as well as similar analyses of all proposed new activities.

This report is submitted as an Environmental Statement for Ames Research Center in accordance with requirements of NMI 8800.7, January 7, 1971.

II. CENTER MISSION

Located thirty-five miles south of San Francisco near Mountain View, California, Ames has over 1900 employees of whom more than 800 are scientists and engineers.

The facilities at Ames include many specialized and unique laboratories for aerospace research in the physical, biological, space and computer sciences. A number of wind tunnels, entry-heating simulators, and flight ballistic test facilities are capable of conducting tests at speeds up to Mach 50. Several flight simulators help to determine man's relationship to the aeronautical vehicle. In addition, laboratories are equipped to study solar and geophysical phenomena, origin of life, life detection and life environment factors.

Ames studies on basic atmosphere entry heating and aerodynamic characteristics contributed to the design of Mercury, Gemini and Apollo spacecraft. Ames scientists did early research for swept-wing aircraft and originated the wingless lifting body concept for manned atmosphere entry. The Center continues to monitor four Pioneer interplanetary spacecraft in solar orbit which provide new understanding of our Sun and interplanetary space.

Almost half of Ames research is for current and future U. S. aircraft development. Major research efforts include work on short take-off and landing aircraft (STOL) for urban transportation systems and NASA's earth-to-orbit-and-back reusable space shuttle vehicle.

Center scientists investigate the evolution and characteristics of planetary bodies such as the Earth, Moon, Mars, and Jupiter.

Two Pioneers are scheduled for exploring the solar system beyond Mars in 1972 and 1973. An expanding airborne sciences program provides the scientific community a means for studies ranging from earth resources to infrared astronomy.

As NASA's Center with primary responsibility for life sciences research, life scientists have traced the major chemical steps believed to have led to the origin of life on Earth and perhaps other planets. The Center will be responsible for experimentation to search for life on Mars with the Viking spacecraft.

Ames conducts cooperative research programs with other agencies, universities and industry. The imminent location at Ames of highly sophisticated computer resources (Illiac IV) should enhance these cooperative relationships.

III. GEOLOGY

The southern end of the San Francisco Bay is a sedimentary deposit of organic and non-organic soils. A number of soil borings have been taken at specific facility sites throughout the Center and a solid foundation has not been encountered. However, at a depth of from 10 to 30 feet a non-organic stiff clayey soil is encounterd which can bear loads of up to 1500 pounds per square foot. Such a soil has proved very satisfactory for friction pile or floating mat type foundations.

The water table varies throughout the Center and is generally higher closer to the bay boundary, three to five feet. As one moves away from the bay it drops to eight to twelve feet.

Test borings have shown fairly consistent soil densities throughout the Center to be about 100 pounds per square foot and moisture content varying from 10 to 35%.

High load bearing road construction requires removal of from two to four feet of top soil and back filling with imported rock or gravel before the top surface is applied.

IV. CLIMATE

One of the reasons of selecting the site for the Ames Research Center was its mild, equable climate. The mean annual temperature is 57° F and the average daily temperature varies from 64° F in August to 47° F in January.

The mean annual rainfall is approximately fifteen inches, 90% of which falls in the six month period from November to April.

The prevailing winds during the day, averaging about 8 mph are from the north and northwest, shifting more westerly and reducing velocity to approximately 5.5 mph during the night.

The Center is south of the fog belt which covers much of the San Francisco Bay Area and enjoys visual flight conditions 96.6% of the year.

The location of the Center is such that the serious weather phenomenon, such as floods, snow, high winds, lightning, etc. need not be considered in the design and operation of facilities.

V. UTILITIES

Potable Water

Hetch Hetchy Reservoir is the source of potable water at the Center. Water from this source is delivered to the Navy at Moffett Field by the San Francisco Water Works. The Navy in turn delivers water to the Center piping system, and the cost is included in the general Navy fee. The purity of the water is so high that only a minimum amount of treatment with chemicals is required to maintain acceptable water quality in cooling towers and boilers.

Sewage Disposal

There are two sanitary sewerage outfalls from Ames. The northern half of the Center is connected to a main connected directly to the City of Mountain View Sewage Treatment Plant. The Center contracts with the city for this service on a volume basis. There are also limits placed on chemical contaminants and pH. The remainder of the Center is connected to a line on Navy property which is connected to the City of Sunnyvale Sewage Treatment Plant. The cost of this service is included in the general Navy fee. Both of these lines are periodically monitored for radioactive and chemical contaminants. No reports of levels in excess of accepted standards have been received.

Steam and Hot Water Boilers

The Center has forty-five natural gas fired steam and hot water boilers installed for providing heat and hot water. All natural gas is purchased from the Pacific Gas and Electric Company. Total installed burner capacity is 418,124,820 BTU/hour. Gas consumption for the calendar year 1970 was 37,788 cubic feet per month. Included in the installation

of each boiler is a requirement to test and adjust for zero CO emission. Several of the boilers are being refitted with new burner control systems and during this refit the burners will be readjusted. In addition, all boilers are being placed on a periodic readjustment schedule to insure minimum CO emission.

There are two other large gas fired facilities at the Center. The pebble bed heater for the 3.5 foot wind tunnel and the steam boiler for the steam ejector vacuum system for the arc jets. Both of these facilities operate intermittently though the frequency has increased recently in support of the space shuttle. The pebble bed heater has a maximum capacity of 3×10^7 BTU/hour and during operation a total combustible gas analyzer is in operation. It is interlocked to shut down the gas supply if total combustibles reaches 2%. During normal operation no combustibles are detectable.

The arc jet boiler is a surplus U. S. Navy Cruiser boiler converted to natural gas fuel with a maximum capacity of 3×10^7 BTU/hour. With the present installation it cannot be operated in excess of 2×10^7 BTU/hour and the gas consumption has been averaging about 2×10^7 cubic feet per month. The burners are adjusted by a contractor twice a year for optimum burner efficiency.

VI. RADIOACTIVE AND HAZARDOUS WASTE DISPOSAL

The use of radioisotopes were first initiated at the Ames Research Center in December of 1961. Radioisotopes were initially used at the Center as biological tracers. The Ames Radioisotope and Radiation Safety Committee was established according to Title 10, Code of Federal Regulations, Part 30.24 (10-CFR-30). The primary purpose of this committee is to maintain radiation safety standards within the Center in conformance with the requirements of 10-CFR-20, 30, 31, 71, and the recommendations of NBS Handbook 69. The committee reviews and regulates the use of all the radioisotopes as well as all radiation producing instruments and machines.

The disposal of radioactive waste has been contracted for since the inception of the use of these materials. Both liquid and solid radioactive waste is collected from individual laboratories and transported by the contractor in AEC approved containers. In 1970 the Center averaged 6 μci per month of radioactive waste. In addition to radioactive waste, all toxic chemicals, corrosive acids and alkalies are disposed of by our waste disposal contractor. For example, all concentrated sulfuric acid-dichromate glass washing solution used in biological research work is transported by our contractor to their waste disposal site.

Each radioisotope laboratory is furnished with a fume hood designed for radioisotope work. The exhaust system of each of these fume hoods is equipped with an absolute, Hepa-type filter.

The Center carries out a continuing monitoring program. In addition to regular, frequent monitoring of individual radioisotope laboratories,

Ames has conducted an annual environmental monitoring program since 1964. Each year the programmatical approach has been to: 1) review and evaluate the radionuclide usage sites, 2) review and evaluate environmental sampling sites, 3) use uniform sampling procedures, 4) use uniform analytical procedures, and 5) report data in a manner which would permit comparisons with previous surveys conducted by NASA-ARC and state and federal agencies. The radioactivity levels of both on-site and off-site soil, vegetation and sewage samples are checked for any increase in activity levels above those expected fluctuations around normal background.

VII. PESTICIDE SELECTION AND APPLICATION

The actual selection and application of pesticides and herbicides at the Center is done by a contractor. He is required by the terms of the contract to receive prior approval from the Center Safety Office for any materials selected or application methods proposed. The Safety Office uses the guidelines established in the U. S. Department of Agriculture Handbook 332 to evaluate the selection of herbicides and the reports of the Subcommittee on Pesticides of the President's Cabinet Committee on the Environment for pesticide selection.

A yearly report is sent to the Director, Occupational Medicine and Environmental Health Division, Code BG, on pesticides and herbicides used at the Center. This office submits an Agency-wide report to the Subcommittee on Pesticides.

As a result of reports from the Subcommittee several proposed pesticides have been rejected for use at the Center. The criteria used by the Safety Office in evaluating a pesticide, herbicide, or application method includes safety of personnel contacting plants, lawns, shrubs, etc. following application and the potential for adverse ecological effects. In these areas the guidelines of the Subcommittee on Pesticides have been particularly useful. The use of pesticides is under continual review and the material selected and application methods approved are updated as soon as new information becomes available and contracting procedures permit.

VIII. COOLING TOWERS

A number of cooling towers of various sizes are operated at the Center in conjunction with air conditioning and research equipment. Chemicals are added to the water for the purpose of corrosion, fungus and pH control. The water from these towers is pumped into the storm drains and then either directly to the bay or to the Navy storm drain system and then to the bay.

The Water Quality Control Board has taken grab samples from these outfalls and found no evidence of pollution. A contractor has also taken samples directly from the storm drain, and their report shows no pollutants above accepted water quality standards.

Discussions are being held with the City of Mountain View and the Environmental Protection Agency on the possibility of putting all of our cooling tower outfalls into the sanitary sewage treatment plant. If this connection can be effected the cooling tower overflow will be diluted by the combined sewage of Mountain View, Los Altos, and Palo Alto, and most of the processing chemicals will be removed at the plant.

IX. POLLUTION CONTROL PROGRAM

A program of environmental pollution control has been in effect at Ames for many years. The San Francisco Bay Area is an area of high environmental quality awareness, and the Center has participated in this awareness by taking a position of leadership in pollution control. A continuing effort is underway to identify and correct pollution problems. As important as the corrective effort is a program of facility design and modification review to identify potential sources of pollution and engineer safeguards prior to their becoming a problem. This approach represents the best method of minimizing pollution and most often offers the best solution to the problem. It also avoids the after the fact problems of operations, scheduling, and funding.

This approach to the minimization of our contribution to environmental pollution has been effective in correcting all but three sources: (1) the Arc Jet facility which became a problem as a result of changing the operating power level and duty cycle; (2) the sawdust which accumulates in the Carpenter Shop during routine day-to-day operation; (3) noise generated by the 11-foot compressor section of the Unitary Plan Wind Tunnel. In all cases corrective action is being taken and is discussed later in this report.

Initially, the Research Facilities and Equipment Division was made responsible for conducting reviews for pollution and responding to inquiries from outside pollution control agencies. This was appropriate in that that Division is responsible for the design and modification of all facilities at the Center, and, therefore, was in the best position to conduct the necessary preliminary reviews. The amount of time and number

of people involved in this work has been steadily increasing resulting in the need for a more formal organization in the area of pollution control.

The new organization assigns primary responsibility for minimizing the environmental pollution emanating from the Center to the Environment Pollution Control Committee. This Committee will review all proposals for new facilities and facility modifications to insure that no new pollution sources are being generated. They will also review any existing facilities that are suspected of emitting unacceptable amounts of pollution. The Committee will also designate one of its members to be responsible for insuring that the various reports required by outside pollution control agencies are filed on schedule and for serving as the prime interface with local, state, and federal regulatory agencies. The membership will include the Chief, Health and Safety Office, the Executive Engineer of the Chemical Research Projects Office, and the Supervising Engineer of the Research Facilities Engineering Branch. The Committee will be able to call on various Center personnel when the solution to a particular problem falls outside of their expertise. They will report directly to the Deputy Director.

X. CURRENT ABATEMENT PROJECTS

The three identified sources of pollution at the Center are discussed in this section.

Arc Jets

The Arc Jets operated by the Thermal Protection Branch have been in operation for a number of years. Due to the very low duty cycle on which they were operated they were not considered an unacceptable source of pollution though it was known that they emitted NO_x in small quantities. In recent months their operating schedule has increased markedly to accommodate Space Shuttle research. For example, they have been operated as much in the first three months of space shuttle testing as in the prior six years of operation. There is also a proposal in the FY '72 C of F budget to increase their operating level from 20 to 60 megawatts. With this kind of operating level the NO_x emission became an unacceptable pollution source. This determination has been made by responsible management personnel including the Director and not by an outside regulating agency. In fact, there are no limits on NO_x emission from stationary sources; however, it was felt that the Center should take a lead position in this area. Management is of the opinion that, in time, limits on NO_x emission will be established and the Center should be in a position to meet those standards. The solution to this problem is a combination of hold up in large vacuum spheres and subsequent exhausting through a liquid-gas (urea-ammonia) scrubbing tower. An interim solution is being provided which washes the gas through a large set of cooling towers.

Carpenter Shop

The Carpenter Shop located under the 40- by 80-Foot Wind Tunnel accumulates a considerable amount of sawdust during routine operation. This is a safety hazard as much as it is a pollution source. At present the sawdust is collected and stored in waste cans until it is removed by our solid waste disposal contractor. A new collection method has been designed which consists of a vacuum system with collection lines leading from the various sources in the shop to a cyclone separator where the sawdust will be collected in a waste container for pick up by the contractor. This system will keep the shop essentially free of sawdust as well as eliminating the sweeping which contributes to airborne particulates.

Unitary Wind Tunnel

Recently a number of complaints have been received from individuals in surrounding communities concerning annoying noise. After an investigation by Center personnel as well as an acoustic contractor, it has been determined that the source is the 11-foot compressor section of the Unitary Plan Wind Tunnel. During particular meteorological conditions noise generated by the compressor is reflected into the surrounding communities. The acoustic contractor recommended several alternative solutions for absorbing this sound at the source and a design to implement one of the recommendations is underway. Code BX has given assurance that funding will be available to implement the design when it is completed.

Reviews of Center facilities are being continued and additional sources may be identified which require abatement. Monitoring programs

are being intensified to insure that emissions and effluents remain within accepted standards. Through its pollution control program the Center has assumed a position of leadership in the role of preserving the quality of our environment.

XI. INTERFACES WITH OTHER GOVERNMENTAL AGENCIES

The following agencies exercise regulatory responsibility for the San Francisco Bay Area or require periodic reports from Ames. None of the agencies which measure Center emissions and effluents have reported pollution greater than allowed by established standards.

A. Bay Area Pollution Control District

Responsible for monitoring stack emission; set and enforce standards for seven county region. No adverse reports filed on emission from Ames.

B. State of California Water Quality Control Board

Responsible for monitoring streams, rivers, lakes and some ocean water. Sets standards. Takes grab samples from Ames storm drain outfall. No adverse reports on Ames effluents.

C. City of Mountain View Sewage Treatment Plant

Accepts Ames sanitary sewer effluents. Sets standards on total volume and contamination level which they will accept.

D. Federal Water Pollution Control Administration, Regional Director, Southwest Region

Yearly report submitted in May. Reports on both sewer and storm drain as to pollution.

E. NASA Headquarters, Code BX

Report filed yearly, due in May. Report covers programs for prevention, control and abatement of water and air pollution.

F. Department of Health, Education and Welfare, National Air Pollution Control Administration

File reports as requested on air pollution originating at the Center.

XII. ENVIRONMENTAL IMPACT OF CENTER ACTIVITIES

All of the present activities have been reviewed for existing or potential environmental impact. Corrective actions are being initiated for those activities which have been identified as having a potential for environmental pollution. Details of these actions are described in Section X. In addition, the Environmental Pollution Control Committee is responsible for similarly reviewing all proposed new activities. The Committee requests responsible managers to provide environmental impact assessments for those proposed projects which could have an adverse impact. Modifications are initiated for those projects which are identified as having an adverse environmental impact.

With this review procedure in effect and with the previously mentioned abatement projects the Center has no detectable adverse environmental impact.

XIII. ADVERSE ENVIRONMENTAL EFFECTS

There are no identifiable adverse environmental effects from Center activities. None of the governmental agencies with whom we interact have detected any such effects. A program is underway which continually monitors Center activities to insure that such effects do not manifest themselves at some future time.

XIV. ALTERNATIVES TO EXISTING AND PROPOSED ACTIVITIES

In those Center activities identified as having a potential for adverse environmental impact alternative approaches or corrective actions are considered and changes are made to eliminate such effects. The Environmental Pollution Control Committee assists in the search for alternative approaches when such a need arises.

XV. SHORT TERM - LONG TERM TRADE-OFFS

Many of the activities of the Center are designed to enhance man's long term use of the environment. Projects in this category include an earth observation program, a clean exhaust internal combustion engine, research in fire retardant polymeric materials to replace natural materials, and an extensive STOL hardware and system research program for future mass transportation users.

XVI. IRREVERSIBLE RESOURCE COMMITMENTS

None of the Center's activities have been identified as requiring an irreversible exhaustion of any resources. If such an identification were made a maximum effort would be initiated to find an alternative course of action which would not require such a commitment.

XVII. DRAFT STATEMENT

The Draft Statement was sent to the Council of Environmental Quality on March 1, 1971. It was also sent to the Office of Management and Budget and the Environmental Protection Agency. No comments have been received from any of these agencies.